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PROBLEMS IN REVIEW

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Businessmen Review the Space Effort

By EDWARD E. FURASH



NASA CR 51798

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HARVARD BUSINESS REVIEW

SEPTEMBER-OCTOBER 1963

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Businessmen Review the Space Effort

By EDWARD E. FURASH *

WASA CR-51786



COMMITTEE ON SPACE 12 GARDEN STREET CAMBRIDGE 38, MASSACHUSETTS

(NASA Grant NsG-253-62)

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PROBLEMS IN REVIEW



DAVID R. SARGENT

President
United Business Service
"The human race has to move forward."



SIMON RAMO

Vice-Chairman of the Board
Thompson Ramo Wooldridge
Inc.

"There is now what might be called the world 'Science Olympics.'"



MICHAEL G. O'NEIL
President
General Tire & Rubber
Company

"In both a military and political sense, [reaching the moon] is necessary for our survival."



GEORGE K. BENNETT

President
The Psychological Corporation

"In every period of crisis, . . . we manage . . . to discover ways of utilizing people to their fullest capacities."

Businessmen Review the Space Effort

Have businessmen changed their rosy views about the space program, now that some of the glamour may have worn off? After an intensive study, HBR reports the answers to this and many other questions raised to executives by the space program — its goals and achievements, its potential commercial payoff, its cost and value.

Current executive views are compared with those expressed by businessmen in a similar study three years ago.

The author is Edward E. Furash, Secretary to the Committee on Space, American Academy of Arts and Sciences.

• THE EDITORS

"For it's only a paper moon,
"Hanging over a cardboard sea...."
(Popular Song)

Whatever the moon is made of, we are going to send someone there to look around and find out. And whether you are for the trip or against it, you'll probably agree that our nation will never be the same again for having decided to lay our prestige on the line and race Russia there.

Back in the "Model-T" days of the space age, HBR surveyed its readers for their attitudes toward space research and our space programs. The finding was an overwhelmingly enthusiastic approval. But a great deal has happened since then, including a \$30-billion price tag on going to the moon and much speculation as to whether it is worth it.

A quick perusal of newspapers and newsmagazines over the past year will reveal that this has been no polite argument. Some critics are concerned that the moon race will harm science; others feel that space research spin-off has not been what was so highly promised.2 For still others the problem is in the cost — the fact that the price of going to the moon could buy a great many earthly goods and services. One might even come away with the general impression that the civilian space program has less solid support than in the immediate past.

Has business changed its views on the space program? For the answer to this question, HBR conducted interviews in depth and surveyed a cross section of its own readers, as well as other executives in U.S. industry. This survey also provided a unique opportunity to study the opinions of business ex-

ecutives over time by comparing 1963 results with the 1960 survey data.

With this in mind two questionnaire forms were designed. The first was an exact copy of the 1960 study; the second focused on the issues that have come up since 1960, but included a number of duplicate questions from the first form so that the two could be used in tandem and closely checked against each other for differences in response. Our sample was split into two halves by alternating the questionnaire forms as they were mailed out. The questionnaires were completed by over 3,500 businessmen — 27% of those polled. (For a profile of respondents, see EXHIBIT I.) The rate of return for the two 1963 questionnaire forms was almost identical, and extensive split tests reveal no meaningful differences in opinion between the two responding groups. The demographic characteristics of the two half samples match very closely, as well. The high rate of return on these comprehensive questionnaires, along with the written comments added by 8 out of every 10 respondents, bears testimony to the importance of this subject to executives, regardless of industry, age, company size, functional field, or management position.

As for comparison with the 1960 survey, a look at Exhibit 1 will help persuade the reader that although these are not identical persons, the very close match in demographic characteristics between the two studies would enable us to make meaningful comparisons between them. Here are some of the major highlights of the study:

• For executives, both today and in 1960, the dual goals of our space

efforts are to build a strong nation through scientific and economic payoff and to keep ahead of Russia militarily. (See "Same Goals.")

- Executives believe that the space program will pay off handsomely in products for our everyday lives. But they have an even greater expectation that the space program will revolutionize our technology. (See "Space Will Pay Off.")
- Seven executives out of ten believe that the USSR is ahead in the race to land a man on the moon. And six executives out of ten think the Russians will beat us there by over a year and a half. For the total group lumping the pessimists in with the optimists the figure is still almost a year. (See "What About Russia?")
- And while most executives believe it matters very much who reaches the moon first, only four executives out of ten would speed up the space program. (See "Speed Up?")
- The reason? NASA is getting just about enough money now, say executives. Unlike our respondents in 1960, most executives would not raise the NASA budget. What to do? Learn to make better use of present funds. (See "Efficiency" and "Dollars & Sense.")
- If we rule out having to go into space for military reasons, executives are more likely to opt for a tax cut over space program spending today than in 1960. The worry? Government spending. The federal budget

AUTHOR'S NOTE: This survey was sponsored jointly by HBR and by the Committee on Space of the American Academy of Arts and Sciences as part of its studies assessing the effect of science and technology on American life. I am indebted to Professor Raymond A. Bauer of the Harvard Graduate School of Business Administration for his aid and counsel in the development of the study.

¹ See Raymond A. Bauer, "Executives Probe Space" (Problems in Review), HBR September-October 1960, p. 6. ² Robert A. Solo, "Gearing Military

² Robert A. Solo, "Gearing Military R & D to Economic Growth," HBR November-December 1962, p. 49.

		M	anagemer	nt position		
Top management				rd; board member; ownedivision or executive vi		1960
president; vice president; treasurer; secretary- treasurer; controller; secretary (to the corpora- tion); general manager; general superintendent; editor; administrative director; dean and as- sistants thereto.						45%
Unner middle					47%	
Upper middle management = functional department head (e.g., advertising, sales, promotion, production, purchasing, personnel, engineering, public relations, brand manager, and the like).					er-	23
Lower middle						
management		ager; b		al department head; distri nager; section manager; an		13
37					- •	-0
Nonmanagement personnel		thers e	mployed	in business.	8	10
Professional	= docto	r; pra	cticing la	wyer; practicing CPA; pi	·o-	
	fesso	r; con	sultant; n	nilitary officer; governme	nt	
	offici	al; uni	on officia	l; clergyman; and the lik	ce. 6	9
-	1 - 7			4		
For	nal educa	tion		Age		
		1963	1960	TY-1	1963	1960
High school		4%	8%	Under 30 years	9%	9%
College		49	51	30-34 35-39	12 15	15 19
Graduate school		47	41	35-39 40-44	18	19
				45-49	16	15
Inc	dustry			50-54	13	10
		1963	1960	55-59	9	7
Manufacturing co	onsumer		- ,	60–65	6	4
goods		18 $\%$	16%	Over 65	2	2
Manufacturing ir	ıdustrial			Income gr	roun	
goods	:-	24	25	Theome gr	=	
Advertising, med publishing	ıa,	4	5	*** 1	1963	1960
Banking, investm	ient.	4	3	Under \$10,000	9%	16% 48
insurance	,	11	8	\$10,000–19,999 \$20,000–29,999	40 21	20
Construction, mir	ıing, oil	6	5	\$30,000-39,999	11	7
Defense or space		8	*	\$40,000–49,999	7	3
Engineering, rese	arch and			\$50,000-74,999	7	3
development Education, social	corrison	*	10	\$75,000-99,999	2	2
Government	services	4 3	*	\$100,000 and over	3	1
Management con business service			т 6	Company size by num	ber of em	oloyees
Personal consum		4 es 2	3		1963	1960
Retail or wholesa		6	3 10	1–49	13%	15%
Transportation, p		•		50-99	5	7
utilities		6	5	100-249	8	10
Other		4	7	250-499	7	9
				500-999	8	8
				1,000-4,999 5,000-9,999	20 9	19 7
				10,000-20,000	10	6
				0		

^{*} Not asked.

Note: Of the 3,515 total returns (27% response) in 1963, 94% were received in time for machine tabulation. Of the 1,950 total returns (31.5% response) in 1960, 88% were received in time for machine tabulation.

Over 20,000

has grown and grown and grown, and, say many executives, some other spending programs have to have a limit if we are to spend on space. (See "Dollars & Sense.")

- Executives enter an insistent plea to government: Don't shut private industry out by creating more government research facilities. (See "Role of Private Industry.")
- Who should benefit from the civilian applications of government-
- sponsored research? Five executives out of ten propose solutions to this thorny problem which would have government keep the rights to civilian use, putting the application into a common pool for all to use either free of charge or for a royalty. (See "Payoffs Questioned.")

20

19

• Executives are split over the hot issue of whether the space program will dry up industrial research by drawing off scientific manpower. (See "Manpower.")

- Let's keep politics out of the space effort, say executives, as seven out of ten reject the idea of using the space program to build up economically distressed areas. (See "No Politics!")
- The newness of space has worn off, and executives are more likely now to appraise space programs for what they mean to them personally: big government, federal spending, unlimited horizons, and spin-off. (See "Young vs. Old.")

SOBERED ENTHUSIASM

The question of whether businessmen are more or less "in favor of" space research and the space program today than in 1960 is not easy to answer. Views on the space program are a complex of opinions and attitudes about the cold war, science, government spending, individual liberties, national defense, research and development, free enterprise, taxes, politics, and a host of other matters.

Thus, in comparing our 1960 and 1963 surveys, we must go further than assuring ourselves that the respondents are comparable. The context within which the opinions are set must also be examined. While we cannot attempt a full exposition here, the following elements should be noted in any 1960–1963 comparison:

- Space has become considerably more of a reality since our 1960 study; both the United States and Russia have demonstrated that man can go into outer space and stay there.
- A new Administration has come to Washington and added "landing a man on the moon by 1970" to our list of national goals.
- Promises of untold technological spin-off and product payoff from space research have been touted and doubted by both industry and government spokesmen.
- The question of taxes, and a possible tax cut, has become more immediate.

With this context in mind, and recognizing that the close similarity between the 1960 and 1963 samples allows meaningful comparisons to be made, let us turn to our respondents' over-all appraisal of the space program.

The 1960 HBR study indicated a surprisingly high degree of favorableness toward the civilian space program on the part of the businessmen surveyed. This year we again asked executives to comment on four possible statements of a "gee whiz" variety that indicate general enthusiasm for the space program. Their responses, together with those from the 1960 study, are summarized in Exhibit

The data presented in EXHIBIT II indicate that while there has been some diminution in general optimism since 1960, businessmen still view the space program very enthusiastically. Looking at the data on which Exhibit II is based. we find two kinds of changes: (1) there is a slight increase (over 1960) in the number of respondents who only partially agree with these statements; and (2) there is a comparative decline (from 1960) in the number of respondents who wholly agree with these statements. However, this small shift toward disagreement is not sufficient in itself to indicate any marked change in attitude toward the space program. At most the changes noted above indicate that there has been some sobering of opinion from the extremely high, almost euphoric, favorableness shown in 1960. Sobered or not, however, the vast majority of our respondents would still agree with these enthusiastic statements. Further insight into this general optimism can be seen in these statements from survey respondents:

• "The exploration of space, just like exploration of any unknown in the past, is as inevitable as the curiosity of the human mind." [District Sales Manager, airline company]

• "The two largest and most significant values of the space program are: (1) It is stretching men's minds. To consider the moon as a place rather than as a 'thing' gives new dimensions to all familiar objects. The earth is smaller — man is prouder and humbler. (2) The space program itself is a great energizing force on our society." [Vice President, large mineral processing company]

As for this idea that man has to go into space, David R. Sargent, President of United Business Service, observes:

"I have heard a number of people talk about the space program. And I have heard some of them question our reasons for undertaking the project by being concerned about what we will get in return, where it is going to get us, the admittedly great cost. Others have tried to justify the program by citing the valuable byproducts that will repay our invest-

"But they all miss the point of the space story: the human race has to move forward. I suppose this is a rather mystical statement, but I believe the human race has always crossed the ocean and climbed the mountain that was in sight, or explored the fringe of the unknown, whether in mathematics or geography. And we will continue to do so, for the basic reason that we have to.

"As a practical matter, our competition with Russia has given impetus to this endeavor. But if we were to remain a vibrant nation - as we have always been — we could not have ignored the challenge of space for long. Our goal is twofold: to keep our society alive and moving forward, and to compete in a competitive world.'

SAME GOALS

The 1960 study isolated these five goals for our space program, and asked executives to rank them

Possible statements about	Per cent of all res wholly or partly wi	
space program	1963	1960
"I'd hate to put any limit on what will result from the space programs. After all, anything could happen. Look what has already happened in the past!"	80%	89%
"Outer space is the new frontier. Re- search and exploration will have pro- found and revolutionary effects on our economic growth."	7 6	8 ₅
"Mankind wants to go into outer space because it is there we are drawn by our desire to know and conquer anew."	87	89
"The horizons that will be opened to man by the exploration of outer space are not recognized by most people today."	88	92

EXHIBIT II. EXECUTIVES ARE STILL OPTIMISTIC ABOUT THE SPACE PROGRAM

in order of priority so as to determine their views on the purpose of space research and, thereby, their possible reasons for supporting the space program: (1) military and political considerations; (2) prospect of economic payoff from research results; (3) a general sense of adventure; (4) desire for increased knowledge; and (5) the wish to win the race for prestige with the Soviet Union. Granted that none of these reasons can be cleanly separated from the others: nonetheless, they do offer opportunity to see relative values. We again presented these goals to our respondents and asked that they rank them from 1 to 5 in order of priority.

Executives place the objectives in precisely the same order of priority in 1963 as in 1960, though the average rankings are somewhat closer together. "Pure science research and gaining of knowledge," with an average rank of 2.0, still is clearly the goal most highly rated by businessmen. The details appear in Ехнівіт III. It is not easy, however, to explain what the order of ranking means. Each respondent in our survey seems to have ranked these objectives in a particular combination that represents his goals, his views of the space program. But we may be able to discern which patterns are more frequent, and which less.

While at first glance it may appear that "pure science" and "control of outer space" represent a dichotomy to our respondents, actually these two goals are a popular 1-2 (or 2-1) combination. An analysis of the data shows three definite opinion patterns:

- 1. The majority (54%) view both keeping ahead of Russia and science payoff as close choices.
- 2. A large minority (35%) see the pure science and economic payoff potential of space research as primary reasons for our space program.
- 3. A smaller minority (11%) see military advantage and prestige as primary reasons for our space program.

Some additional data at this point may help us differentiate between these patterns even more clearly:

- 28% of all respondents agree with the statement, "This whole idea of competing with Russia in a race for space is nonsense," as against 19% in 1960.
- 58% of all respondents agree with the statement, "The country that controls outer space controls the

Ramo, Vice-Chairman of the Board of Thompson Ramo Wooldridge Inc., would not fully agree with our respondents in putting "prestige" in last place:

"There is now what might be called the world 'Science Olympics.' Let us

EXHIBIT III. EXECUTIVES CONTINUE TO RATE PURE SCIENCE AS PRIME OBJECTIVE OF SPACE RESEARCH

POSSIBLE OBJECTIVES	FIRST CHOICE*	AVERAGE RANK 1963	AVERAGE RANK 1960
PURE SCIENCE RESEARCH AND GAINING OF KNOWLEDGE	43%		1.9
CONTROL OF OUTER SPACE FOR MILITARY AND POLITICAL REASONS	31%		2.6
TANGIBLE ECONOMIC PAYOFF AND RESEARCH RESULTS FOR EVERYDAY LIFE ON EARTH	18%		3.0
MEETING THE CHALLENGE AND ADVENTURE OF NEW HORIZONS	8%		3.6
WINNING THE PRESTIGE RACE WITH THE SOVIET UNION	5%		3.9

^{*} Per cent of all respondents ranking this objective as most important.

destiny of the earth," as against 67% in 1960.

• 71% of all respondents emphatically say "No" to the question, "Do you think that control of outer space is the most important military objective that our country should have?"

As for military control of outer space, and our sample's apparent rejection of the idea that it is the most important military objective our country should have, a comment is necessary. Our respondents probably show more wisdom in answering the question than we did in asking it. Their comments point out that while outer space is an important military objective, it is not the *most* important military goal for our nation. Supremacy in nuclear weapons, the ability to conduct limited war successfully, and maintaining an over-all strong defense posture are equally as important as outer space military supremacy. For our respondents, outer space is an important military objective (a top-ranked goal for our space program, and seen as a point from which to control the earth), but not one that overrides all other defense considerations.

On this subject of rating the space program's objectives, Simon

not underestimate nor be ashamed of an interest in science that is partly for prestige purposes. To much of the world, scientific superiority tends to connote military superiority, not immediately perhaps, but in the long run. To many it implies an ascendancy of the systems of society and of the government standing behind that scientific excellence. To attain prestige through scientific prowess requires both the substantive achievement and the worldwide recognition of the importance of that achievement when it comes. The first may be in the field of science, but the second is in the field of international public relations. A program the objectives of which include prestige, but which is focused entirely on bringing off the technical achievement, is still only half a program for

"We already have proof of this. In the Science Olympics it ought to be total points that count. It is difficult to find an American scientist, industrialist, or government spokesman who does not believe that on balance we are ahead of any nation in total scientific research. Even in space, while the Soviet Union has had a man in orbit longer, we believe we are ahead in general exploration, in interplanetary probes, in weather observation, in navigation, and in the utilization of space for communications.

"But most of us are concerned that we have not been doing well on the prestige front. Why? Presum-

ably only because, not having acknowledged fully that there is a prestige battle, having been hesitant to dignify efforts to win prestige by facing up to such a purpose as an important parameter, we have not done the best possible job of presenting our accomplishments to the outside world, or even perhaps to the American public at large. If the Olympics scores are going to be at all close, then it becomes important to tell our story well, across the board."

Putting our findings together in the context of the depth interviews conducted as part of this study, and the many comments written in by our survey respondents, it is clear that today, as in 1960, most executives see our space program goal as "keeping ahead of the U.S.S.R. militarily while at the same time getting as much scientific and economic payoff for ourselves as we can." If we add in the large minority who see space research as a primarily scientific or economic venture, rather than as primarily prestige or military, we would probably be more accurate in saying that while most of our executives see the goal of space research as scientific and economic payoff, this goal is also very much a part of keeping the United States strong and in front of the U.S.S.R.

Michael G. O'Neil, President of the General Tire & Rubber Company, puts our space goals together in this kind of a package:

"There are those who say: Why reach the moon? Why don't we stay right here on earth and attempt to solve a few of our earthbound problems — illiteracy, crime, juvenile delinquency, integration, unemployment, poverty, disease? Why is so much brainpower and cold hard cash being poured into a world so far beyond our terrestrial confines?

"First, in both a military and political sense, it is necessary for our survival. If Russia beats us to the punch, we shall have only ourselves to blame when the Hammer and Sickle tears the Stars and Stripes to shreds.

"Secondly, if we back away from the Space Age, we shall be denying one of the greatest gifts and responsibilities man has: the right to grow and progress.

"Third — and very important — are the benefits that space will bring and has already brought to mankind."

SPACE WILL PAY OFF

The executives surveyed in 1960 felt strongly, just as Mr. O'Neil does, that space research would bring immense benefits to mankind; our findings from the 1963 survey indicate that executives continue to believe that the space program will produce considerable tangible payoff. We presented executives with the same list of possible payoffs from the space program as was used in the 1960 study, and asked them to estimate the likelihood that each payoff has of actually coming about. Their responses, and those of the 1960 sample, are shown in Exhibit iv.

These payoffs can be divided into three categories: (a) research and development payoffs which will have benefits on this planet; (b) payoffs from the earth-circling satellites; (c) payoffs that would be dependent on man's traveling to outer space. The following R & D payoffs which will have benefits on this planet are considered by executives to be "very likely" or "almost certain": new medical and biological knowledge (88%); robot devices (86%); new mathematics and physics (82%); compact nuclear power plants (81%); and new fabricating materials (79%). Every one of these examples is considered more likely to happen by our 1963 sample than by those reporting in 1960.

One reason for this increase in the belief that these particular payoffs will occur is that there has been a great deal of attention given to the whole question of payoffs from the space program, to say nothing of the publicity on specific payoffs that can be traced to space research.

Examples? To date, a number of remarkable results have been chalked up to the space program. New "wonder metals" (cesium, beryllium, tantalum) and exotic new fuels (liquid hydrogen, liquid fluorine) have been developed. Space vehicles have called for the development of new, lightweight, reliable power sources such as fuel cells, thermoelectric systems, nuclear electric power generating facilities. And such products have been translated into everyday use:

tiny mercury batteries for electric wrist watches: nickel cadmium cells, designed to store solar energy and keep instruments operating when a satellite is hidden from the sun, are finding new uses in cordless shavers, flashlights, and other devices. Medicine and dentistry have benefited from the miniature instruments attached to astronauts to measure heartbeat, blood pressure, and the like. Clearly, there have been some payoffs, and executives expect many more to come. Whether executives believe that these benefits are worth what we are paying for them, or that they come free of other problems, are matters that will be discussed later.

As for payoffs from earth satellites, three earth satellite projects have received wide publicity: Transit (navigation); Tiros-Nimbus (weather); and Telstar-Relay (communications). Two of these have shown signs of paying off:

The demonstrated success of Telstar is ample evidence to support the contentions of 96% of our respondents that the space program is "almost certain" or "very likely" to bring about revolutionary improvements in communications. (No one thinks it "never will" happen!)

EXHIBIT IV. EXECUTIVES CONTINUE TO BELIEVE THE SPACE PROGRAM WILL PAY OFF

POSSIBLE PAYOFFS	VERY LIKEL	Y" TO HAPPEN	BELIEF	INDEX *
	1963	1960	1963	1960
REVOLUTIONARY IMPROVEMENTS IN COM- MUNICATIONS (TV, RADIO, TELEPHONE, ETC.)		94%	4.73	4.62
NEW MEDICAL AND BIOLOGICAL KNOWLEDGE		86%	4.45	4.39
ROBOT DEVICES		82%	4.42	4.32
ACCURATE LONG-RANGE WEATHER FORECASTING		87%	4.29	4.37
NEW MATHEMATICS AND PHYSICS	e e e e e e e e e e e e e e e e e e e	81%	4.32	4.29
COMPACT NUCLEAR POWER PLANTS	faryj Margetto	79%	4.25	4.22
NEW FABRICATING MATERIALS		71%	4.29	4.12
NEW PRODUCTS FOR OUR EVERYDAY LIVES			4.14	+
ANTIGRAVITY DEVICES [†]		32%	3.08	3.12
MINING ON OTHER PLANETS		14%	2.55	2.70
A DEVICE TO "CANCEL" THE NATURAL FORCE OF GRAVITY T			2.12	†
COLONIZING OTHER PLANETS		8%	2.26	2.45

^{*}The BELIEF INDEX was calculated by taking a weighted average of the raw data responses in each opinion category. Weights used: "Almost Certain to Happen" = 5; "Very Likely" = 4; "Possible" = 3; "Very Unlikely" = 2; "Never Will Happen" = 1. The highest belief score possible is 5.00; the lowest belief score possible is 1.00.

‡ No data available.

[†] Only half of the total 1963 sample was asked about these three possible payoffs. However, the number of respondents in half the 1963 sample is approximately the same as in the total 1960 sample.

85% of our respondents to believe that "accurate long-range weather forecasting" is "almost certain" or "very likely" to result from the space program.

As in 1960, executives express the greatest reservations as to the practical results of man's travels to other planets — e.g., colonizing or mining other planets. On both items, there is a decline from 1960, and this, together with sharp increases in the proportion of respondents who now say that these things are "very unlikely" or "never will" happen portends at least a mild disillusion with the "anything could happen" philosophy prevalent in 1960. There is still, however, a reluctance to say that anything is "impossible."

One thing is clear: executives expect considerable payoff from the space program in terms of tangible benefits on this planet. Some 71% of all respondents indicate that they expect an eventual application of space-generated knowledge in their own companies. (In 1960, 70% said this.) And 25% of all respondents state that space research knowledge is already being applied in their companies (20% in 1960), with another 11% expecting applications within the next two years (11% in 1960). However, only 10% believe such applications will be the direct result of the space program research and development, while 59% say they will come as a by-product, and 31% indicate the applications will come from both (in 1960, 30% said "direct result"; 78% said "by-product"; we have no data on "both"). What sorts of payoffs? Executives most often cite high temperature metals and nonmetals, new fabricating materials, miniaturizing of electronic equipment, communications improvements, ceramics, food containers, food preservation, efficient power plants, computer technology, and new fuels.

While executives appear to give a high probability to practical R & D payoffs from the space program (and here they are in tune with many who have spoken or written on this issue), we cannot determine whether they do this from specific knowledge (for only 25% have actual applications in their own company), from generalized faith in the space program, or from belief that any large technical effort is bound to generate payoffs. At the same time, the very broad, general expected payoffs suggested by our respondents in 1960 made us wonder whether they anticipated these payoffs from the space program in particular, or merely from our technology in general, perhaps given a boost by the space program. To find out, we asked two new questions in 1963. The first of these was:

(1) "What is the probability that new products for our everyday lives will result from the space program?"

The reply to this question (see EXHIBIT IV) is that some 73% of all respondents believe that this kind of a payoff is "almost certain" or "very likely" to happen. Yet this expectation is considerably lower than that for most of the payoffs listed in Exhibit iv. It appears, then, that though a considerable number of executives believe that the space program will produce products for daily living, their greater expectation is that the program will result in significant, even revolutionary, changes in our over-all technology, such as handy nuclear power, new mathematics, and the like. Whether this belief is founded on fact or is a reflection of promises made for the program, we have no way of knowing.

The second question we asked went beyond the kinds of payoffs to the issue of whether the space program could be credited with sole creation of these payoffs:

(2) "How many of the twelve scientific and economic achievements listed [in Exhibit IV] do you think would happen if there were no space program?"

The verdict:

None	2%	7 or 8	30%
1 or 2	9%	9 or 10	4%
3 or 4	23%	All	1%
5 or 6	31%		

It is the belief of two out of three respondents — and execu-

tives in engineering, R & D, and the military-space industry in particular agree — that half or more of the scientific and economic achievements that we asked about would happen even if there were no space program. While one cannot assume that this verdict means that executives do not believe the space program worthwhile, it does seem to suggest that executives may not consider the space program a fount of new technology or a panacea for our technological ills. Rather, they may very well agree with those who note that the space program appears to be building upon, speeding up, and perhaps even evolving from our existing technological abilities, but not creating a basic, new, or radically different science.

WHAT ABOUT RUSSIA?

Let us now turn our attention to the other major goal of the space program — competing with the Soviet Union.

A comment on one of the questionnaires — from the president of a small retailing organization in Missouri — serves as a neat summary of the feelings of many executives in our survey: "The idea of a 'race' tends to be downgraded, but if intuition serves me, this is quite the most important one ever run."

How do executives view our over-all progress against that of Russia? As in any race, the runners must either win, lose, or tie:

▼ In 1960, 35% of all respondents believed that the Russians were ahead; 22% believed we were ahead; and 43% believed we were about even with the Russians.

▲ In 1963, 31% of all respondents think that the Russians are ahead; 28% believe that we are ahead; and 41% think we are about even with the Russians.

Where respondents believed the Russians to be ahead over-all by a "large nose" in 1960, they now appear to see the two nations more nearly "neck-and-neck." But a race of this kind may be made up of a number of events, and contenders may lead in some and not in others. With this in mind, we asked

the executives in our 1963 survey to give us their opinions as to which nation — the United States or the U.S.S.R. — is doing better in certain selected aspects of space research. A list of the categories asked about and the ratings given each nation can be found on the "scorecard" in Exhibit v.

Whether the responses in Ex-HIBIT v reflect the true state of the the two programs other than to stress that the Russians can organize for a single purpose more readily than we can. But monolithic organization and efficiency do not necessarily go together.

A final comment on the space race scorecard relates to the 70% response ranking the U.S. ahead in "over-all space research achievements." Readers should be cau-

EXHIBIT V. WHO'S AHEAD? AN EXECUTIVE SCORECARD TO THE SPACE RACE

SPACE RESEARCH CATEGORY	UNITED STATES AHEAD	U.S.S.R. AHEAD	BOTH ABOUT THE SAME
CONSUMER AND INDUSTRIAL APPLICATIONS OF SPACE RESEARCH		15	
PURELY SCIENTIFIC SPACE RESEARCH		85	
OVER-ALL SPACE RESEARCH ACHIEVEMENTS	Pros	11%	
ELECTRONICS AND GUIDANCE SYSTEMS) 653 	111%	
EFFICIENT USE OF MANPOWER AND OTHER RESOURCES	37%	33%	
MILITARY APPLICATIONS OF SPACE RESEARCH	175	4* 3-	
ORBITING NUCLEAR WEAPONS			
LANDING A MAN ON THE MOON	***		
POWERFUL ROCKETS AND BOOSTERS	35.	63. 2.	

world or not, they certainly indicate that these executives have followed the news closely, and that messages have come through. News media for the year prior to the 1963 survey (and even before) contained messages very similar to the opinions reported by executives in our survey: Russia has better boosters; we have better electronics. Our space program will yield consumer and industrial applications. Khrushchev boasts about putting bombs in orbit. We successfully probe the secrets of Venus; the Russians put cosmonauts in orbit two at a time. And so on.

That executives are spread apart on the issue of who uses manpower more efficiently proves the point by exception — little or no information has been published concerning the relative efficiency of tioned to interpret this result as an evaluation of space research achievement. When the topic is over-all space accomplishment, executives still see Russia slightly ahead, indicating that businessmen weight the moon race (in which the U.S. is seen lagging) heavily.

THE MOON MATTERS

Although 70% of our respondents say that the Russians are now ahead of the United States in progress toward landing a man on the moon, this does not necessarily mean that they believe as well that the Russians will actually land a man on the moon first. Because President Kennedy has set "landing a man on the moon by 1970" as a national goal, we thought it important to discover which nation executives believe

will be the first to land a man on the moon.

To find out, we presented our sample with a list of dates and other choices, and asked executives to tell us when each country will land a man on the moon and return him safely. A summary of their estimates can be found in Exhibit vi.

Looking at the distribution of estimates in that exhibit, we see that 61% of all respondents believe the U.S.S.R. will land a man on the moon by 1968 or earlier, whereas 55% of all respondents believe that the U.S. will land a man on the moon by 1969 or earlier. How many executives believe the Russians will land a man on the moon before we do? To answer this question, we analyzed our data to discover how many respondents estimate that the Russians will land on the moon in the same year, an earlier year, or a later year than they estimate for the United States. The verdict from all respondents:

- 63% say that the U.S.S.R. will be first (an average of 1.6 years before the U.S.).
- 30% say that the two nations will do it in the same year.
- 7% say that the United States will be first (1.3 years before Russia).

EXHIBIT VI. WHEN WILL EACH COUNTRY LAND A MAN ON THE MOON AND RETURN HIM SAFELY?

YEAR	PER CENT OF ALL RE	ESPONDENTS GIVING
TEAR	UNITED STATES	USSR
1965 OR EARLIER		12%
1966		16%
1967	-/3-2	155
The same of the sa	100	10%
	12%	10%
1970	1975	6%
AFTER 1970	17%	13%
NEVER	2%	2%
CANT SAY	7%	8%
	100%	100%

Note: Arrows indicate median expectation of when moon will be reached.

As a further aspect of this issue, we asked our respondents: "Regardless of who reaches the moon first, do you think it really matters?" The responses:

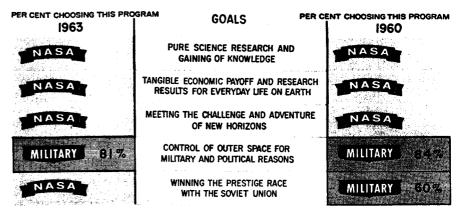
Mr. Sargent puts this question in perspective with the following comment:

"Naturally, I'd like us to reach the moon first, but in the long run I don't think it really matters whether we or the Russians get there first. If they get there one year and we get there the next, that's close enough—the nations that were first to reach this continent didn't necessarily win it. We were considerably ahead of the Russians in the development of atomic weapons, with perhaps a five-year lead or more. They managed to catch up—or nearly so—quite rapidly. I don't see that it was disastrous for them to be second."

If, however, there is an urgency about who reaches the moon first, there are at least two alternatives readily available: change the management of the space program or "speed it up" in some way. Do our respondents want to do either?

CHANGE HORSES?

Our space program splits, of course, into two subprograms: a military program and NASA's civilian program. This same situation existed in 1960, and then as well as now it was possible to shift particular space projects from one management to the other. Since the NASA program was very new in 1960, we were anxious then to find out whether and how executives distinguished between the military and civilian programs. For this purpose we asked three questions: (1) which of the programs would best achieve the broad objectives discussed previously; (2) which would be first to achieve certain specific objectives; and (3) which program is in charge of a number of specific projects? Since we asked the same questions in our 1963 survey, one way to test for a possible desire to "change horses" in the manageEXHIBIT VII. WHICH PROGRAM — NASA or MILITARY — WILL BEST ACHIEVE SPACE RESEARCH OBJECTIVES?



ment of our space program would be to compare the opinions expressed in the two surveys, looking for increases or decreases in preference. The answers to the three questions cited above are given in Exhibits VII, VIII, and IX.

As Exhibit vii points out, businessmen respondents show only one major change in their view of which program can best achieve space research objectives. That change is with regard to winning the prestige race with the Soviet Union: preference now is virtually divided between civilian and military, whereas in 1960 opinion favored the military 3-2. Two considerable changes of businessmen's opinions are noted in Exhibit VIII, again both favoring NASA. However, lest these responses be interpreted as a slap at the military, a brief review of space project facts may clarify the matter.

In 1960, the only definite mission concerning man in space that had been given out was the limited orbiting project, Mercury, and at

the time of our survey this had been assigned to NASA for a relatively short time. The government had yet to determine to go to the moon to establish space stations (or such a decision had not been made public) and so neither project had been assigned publicly either as a civilian or as a military mission.

In 1963, however, the man-onthe-moon project has clearly been given to NASA (Project Apollo), as have the various in-between projects for man in space: twoman capsule orbiting (Gemini) and rendezvous in space (a prelude to establishing a "space station"). Thus the reversals shown in the 1963 data reflect more our respondents' knowledge of the actual project assignments than a preference for military or civilian management.

It would be unfair to interpret our data to signal a rejection of military management of space projects by executives or even as a strong preference for NASA man-

EXHIBIT VIII. WHICH PROGRAM — NASA or MILITARY — WILL BE FIRST TO ACHIEVE RESULTS?

PER CENT GIVING THIS OPIN	PROJECTS PER	1960
NASA	LONG-RANGE WEATHER PREDICTING SYSTEM	NASA
NASA	TRAVEL TO OTHER STARS	NASA
NASA	MAN LANDING ON THE MOON	MILITARY
NASA.	COMPACT NUCLEAR POWER PLANT	NASA
NASA	MANNED SPACE STATIONS	MILITARY

agement. We did not ask this question directly; and even if we had, their answer would perforce be a generalized one, for as things now stand the military does not have a mandate for man-in-space programs of the order of Gemini or Apollo.

At best, there are no signs of great dissatisfaction with NASA as head of these projects in the responses to these particular questions. While we admit that this may be a conservative interpretation of the replies, it also allows another important finding to be brought out: here is additional evidence that our respondents are better informed than they themselves indicate from the comments written on their questionnaires, and another demonstration that they have been doing their reading. The data presented in Ex-HIBIT IX bear out this finding as well. We put executives to a tough test when we asked them to identify the various projects listed.

SPEED UP?

"Do you think," we asked executives, "that the United States needs to speed up its space program?" Their replies:

The over-all response of "no" is somewhat surprising in the light of the opinions already expressed by a majority of respondents that (a) the Russians are ahead in the race to land a man on the moon; (b) they will win the race; and

(c) it matters who wins. Looking

at our data more closely, we find that while there is apparently no relation between the belief that the Soviets will beat us to the moon and a desire to speed up the space effort, there is a clear relationship between the imminence of the date on which a respondent sees the Russians landing on the moon and a desire to speed up the space program. That is, those executives who see the Russians landing on the moon in the near future are far more anxious to speed up our space program than those who see it happening later on.

In addition, those respondents asking to speed up the space program are more concerned with Russia, the race, and military use of outer space. That is, they are somewhat more likely than other respondents to perceive the United States as being "behind," especially where competitive or military issues are most salient.

Taking all these elements into account, there seems to be a substantial minority in our sample (at least 33%) who do feel very strongly about the race to land a man on the moon first, and consequently are the strongest supporters of speeding up the space program. As one of our respondents put it, "the primary purpose of the space program should be to ensure our national security. Thus space should have top priority in the budget."

But what of the remainder of our respondents? They are equally likely to estimate that the Soviets will beat the United States in landing a man on the moon; moreover, some of this group have said that it matters. The explanation for their decision not to suggest a speedup most probably lies in their sense of urgency about the matter, their perception of how well the United States is likely to do given the current pace and organization of the space program, and their willingness to use the methods available for a speedup.

EFFICIENCY

"Speeding up" the space program can take many forms. One can, for example, decide to allocate more funds, spend the same funds over a shorter period of time, or use funds more effectively. In 1960, we asked our respondents, "How do you think we can best speed up the space program?" Some 70% replied, "Make better use of present funds." Yet in a separate analysis of other data gathered in the same study, we learned that this attitude did not prevent 71% of the respondents from favoring an increase in the NASA budget. (To compare the latter point with the present study, see the next section, "Dollars & Sense.") We wondered at the time whether this request for increased efficiency was directed particularly at the space programs, or represented a general overriding belief that the government never uses resources as efficiently as does private industry.

We asked the same question in this year's survey. And the reply was very nearly the same: 72% say, "Make better use of present funds." This year, however, we have some additional information about government and space program efficiency to help determine whether this is a specific accusation of the space program, or a general indictment of all government undertakings. These data tell us that the space program is perceived in a context of government, and to the typical executive government is to a good degree inherently inefficient: 70% of our respondents generally or partially agree with the statement that "government doesn't get as much per dollar out of research as private industry does."

In their view, apparently, the

Exhibit ix. Which program — NASA or Military — is in charge of each project?

Projects (Correct answer in brackets)	Per cent of all r to identify each 1963	espondents able project correctly 1060
Mercury (NASA)	72%	54%
Nike (Military)	96	54 // 97
Weather satellites (NASA)	70	86
Gemini (NASA)	7 7	*
Apollo (NASA)	66	*
Tiros (NASA)	53	55
Telstar (AT&T)†	94	*
Midas (Military)	6 0	*

^{*} Not asked.

† Correctly identified as "private industry."

Source: The correct answers were determined by referring to Horace Jacobs and Eunice Engelke Whitney, Missile and Space Projects Guide (New York, Plenum Press, 1962).

fault is not primarily in the scientists working for government, for 60% of them generally or partially agree with the statement that "government scientists and engineers usually have high professional qualifications" (though the lower agreement on this point may indicate that executives have some doubts as to the quality of men who choose government employment at this level). But even if good men do go into government service, executives see them in a defeating situation: 72% of all respondents partially or generally agree with the idea that "government operations lack the incentives and atmosphere to encourage creative and efficient managers."

Is the space program different from the rest of government? Executives seem to disagree; our respondents' opinions on this statement are distributed in a nearly perfect "bell-shaped" curve — a sure sign that either they cannot determine whether our space programs are better run than most government operations, or that two groups have had quite different experiences or information about space program operations.

However, our respondents' inability to agree on whether our space program is more efficient than most government operations is not a reason to downgrade their plea for increased efficiency. We would be the last to abandon that prayer. And, for these executives, there is a germ of worry about the space program: that on top of the "usual government inefficiency" the hurried pace of the space program is itself a possible breeding ground for waste. Whether this is an intuition or a fact, 67% of our respondents generally or partially agree with the size-up that "the frantic pace of our space program is resulting in an inefficient use of money and scientists." This is a situation, of course, where inefficiency may be the price of trying to get to the moon first and fast. In the words of one respondent:

"The space program needs better coordination — less politics and red tape, deadweight jobholders eliminated, financial leaks plugged. All this to eliminate lost motion, confusion, and cross-purposes which dis-

integrate our money, dilute our efforts, and cloud our goals." [Vice President for Engineering, R & D, Midwest manufacturing company]

A secondary theme of worry bears on possible duplication of effort between NASA and the military:

"Closer cooperation among private industry, NASA, and the military is needed. . . . Too much boondoggling and indecisiveness by civilian chiefs have retarded our military programs. These programs have been the key to the majority of scientific research and findings in the space effort, e.g., Atlas, Jupiter, Thor, and Nike." [Asst. Manager, Industrial Relations, large construction company in the South]

A similar concern about efficiency was raised by our respondents

in 1960. In 1960, however, our respondents were willing not only to forego other economic alternatives in favor of space research, but to increase space spending as well. What about 1963?

DOLLARS & SENSE

If military superiority did not require exploration of outer space, which would be more important, space research or cutting taxes? We asked that question in 1960, and the surprise answer was that 73% of all respondents would choose space research. In response to the same question this year, only 55% of our respondents would make the same choice. Exhibit x contains a full comparison

EXHIBIT X. EXECUTIVES RATE SPACE PROGRAM AGAINST ECONOMIC ALTERNATIVES

PER CENT FAVORING EACH ALTERNATIVE OVER SPACE RESEARCH **ECONOMIC ALTERNATIVE** 1963 1960 **MEDICAL RESEARCH** 86% BETTER EDUCATION FOR OUR CITIZENS 84% 58% **NEW HOSPITALS EXPLORING AND EXPLOITING THE SEAS CUTTING TAXES** 27% REBUILDING OUR CITIES* POWER PLANTS AND DAMS* 39% URBAN MASS TRANSPORTATION* FOREIGN ECONOMIC AID MORE LEISURE AND CONSUMER GOODS 3% SHORTER WORKING HOURS*

† Not asked.

^{*} These comparisons were asked of only half our 1963 sample.

of the 1960 and 1963 economic priorities that executives give purely scientific space research. Clearly, space research is still given a high economic priority even if military considerations are ruled out. Only health and education take precedence, and education is often seen as a precondition for space research.

Taxes deserve an extra comment at this point. Since all subgroups in the survey show an increase in preference for a tax cut contrasted with their sentiments in 1960, more of an explanation is needed. Two possibilities come to mind. First, our 1963 survey was sent out at a time when there was every prospect for a tax cut. The Kennedy Administration had promoted and promised it, and it even looked as if the wheels of Congress might turn it into a reality. In 1960, on the other hand, a tax cut wasn't even being thought about out loud. Now, it is certainly more difficult to forego a tax cut that you have some reasonable expectation of getting than to give up one that you doubt you'll ever see, or probably never imagined. Secondly, perhaps our respondents are not so sanguine in 1963 as they were in 1960 about increasing space program spending; they appear to want to keep it right about where it is. Both explanations probably apply in this situation.

Also on the subject of money, both in 1960 and in 1963 we asked executives to estimate (a) the present expenditure on civilian and military space programs, (b) the amount they thought should be spent on each of these programs, and (c) the amount they expected would be spent five years from now. This is a difficult set of questions, and we ourselves felt uncertain about making such estimates. Not that we expected accurate answers; what we were interested in was whether executives think we should be spending more or less for either of the programs, and whether or not they expect expenditures to increase over the next five years.

The replies for 1963 are contained in EXHIBIT XI. For those in-

EXHIBIT XI. EXECUTIVES ESTIMATE NASA AND MILITARY SPACE PROGRAMS'

SPENDING ESTIMATE		NASA			MILITARY	
(IN DOLLARS PER YEAR)	NOW SPENDING	SHOULD SPEND NOW	WILL SPEND IN 1968	NOW SPENDING	SHOULD SPEND NOW	WILL SPEND IN 1968
ABOUT \$100 SNO	2%	3%	. 0	1%	5%	Ö
ABOUT \$500	5%	5%	13	6 %	8%	25
ABOUT \$1	19%	21%		28%	29%	
ABOUT \$5	46 %	37%		33%	32 %	30 %
ABOUT \$10	16%	18%	31%	17%	14%	
ABOUT \$15	7%	7%		6%	6%	
ABOUT \$20	3%	5%		4%	3%	
ABOUT \$25	1%	2%	45	2%	1%	
OVER \$ 25	1%	2%	55	3%	2%	

terested in whether executives picked the "right" answer for current spending, here are our best estimates. The NASA budget for the year ending in 1963 was about \$3.7 billion, and the budget request for fiscal 1964 (1963-1964) is between \$5 and \$5.7 billion. On that score, our respondents' estimate of \$5 billion for NASA looks like a reasonable figure. The military budget figure is more difficult to come by, for it depends on what one decides to include. We believe it should be limited to R & D programs related to missiles, rocketry, and space, and our estimate for fiscal 1963 just ended would be about \$4.5 billion. Again, our respondents' estimate of \$5 billion appears reasonable.

From Exhibit XI it appears that our respondents think that the civilian space program should be getting just about the amount they estimate it is getting. But data assembled in this form can create false impressions. With this in mind, we reanalyzed our data (both 1960 and 1963) to determine for each respondent whether his estimate of what the budget should be was higher, lower, or the same as he estimated the budget actually was. In 1960, 71% of all respondents thought that the

NASA budget should be higher than they estimated it, while 28% thought the military budget should be similarly raised. In 1963, only 30% vote to raise NASA's budget, with 49% willing to keep the NASA budget right where they estimate it to be, while 21% say it should be lowered. As for the military budget, 17% would raise it, 49% would keep it where they estimate it, and 34% would lower it.

The fact that fewer respondents would raise the NASA budget in 1963 than in 1960 does not necessarily bode ill for the civilian space program. Which is "stronger support"? — an opinion to keep spending at \$5 billion by executives who are demonstrably informed (1963) or an opinion to raise spending over \$900 million by executives who were demonstrably uninformed (1960)? Most of our respondents are willing to support the \$5-billion budget, they say, and the 30% who would increase it are not to be ignored by proponents of more spending. Taken jointly, the 58% vote against a speedup of the space program and the general sentiment against boosting space budgets put more teeth into businessmen's pleas for greater efficiency in the space program. We would suspect that even if executives are in favor of space research, there may be other constraining limits or issues that weigh against higher spending.

To check on this, we gave one positive and one negative statement to split-halves of our sample. The reaction:

"The tax burden imposed by our space program will slow down our economy."

Agree — 28% Can't say — 10% Disagree — 62%

"The tax burden imposed by our space program will not slow down our economy."

Agree — 54% Can't say — 10% Disagree — 36%

Averaging the responses on a single scale tells us that 58% believe the space program's tax burden will not slow down our economy. And the fact that the question reversal affected attitudes very little indicates that opinions on this issue are well-crystallized.

However, this question pertains to the space program as part of the existing tax burden, and the salient issue is that of *increasing* spending. The comments written in on our survey indicate that a vocal minority of our respondents are concerned about taxes, and we think a question about the effects of an *increasing* tax burden might yield different answers.

To what degree do our executives see space-program spending as affecting the government's ability to undertake worthwhile domestic programs? Businessmen split about even on this question, indicating (a) that this is an issue to our respondents, and (b) that consideration of the high level of government spending is not absent when executives think about the space program.

For the present our respondents' concern about taxes and their potential burden on the economy is not so great as to cause them to turn against the space program. The urgency of achieving space supremacy in the cold-war competition with Russia and their desire to obtain scientific and product payoffs from space research is too strong for this to happen. But the issue of taxes, their potential bur-

den on the economy, and high government spending could become important enough to weigh against the space programs should evidence arise that the moon is not Russia's goal, that it is not to our advantage to race there, or that the scientific and product payoffs from space research have been grossly overestimated. (See "Payoffs Questioned" and "Manpower.") All these matters are topics for current debate.

ROLE OF PRIVATE INDUSTRY

One of the long-standing issues surrounding the space program is the role of private industry. At present the great bulk of space technology research and hardware manufacture is in the hands of private industry through government's long-standing contracting and subcontracting procedures. At the same time, some research perhaps even an increasing share - is conducted in government laboratories that are, in effect, in competition with private industry. We have already seen that executives perceive such operations within the context of government and, therefore, in a context of government "inefficiency." What, then, is the role of private industry, and how can this role more effectively help the space program?

First of all, executives realize, "space exploration and research is such an immense undertaking that it could only have been financed by the government" (92%). But whenever possible, they say, "the government should contract research on space technology to private industry rather than use government-owned laboratory centers" (83%). Of course, some (62%) agree with the idea that "the government needs to have its own research organizations in order to evaluate the work of private industry," though a solid minority (33%) say this isn't so. One group (51%) would ask that, "when negotiating with business, government agencies contracting for space research should be allowed greater freedom and flexibility than most government agencies."

Our 1960 study showed a wist-

ful tone on the part of many executives concerning "getting private industry into space business." The greatest barriers were: the immense cost of pioneering in space on one's own; the fact that this cost could not be financed by private industry alone because the profit payoff could not come soon enough; and the fact that it was unrealistic to assume financing could be available from private sources. This same attitude is reflected in the 1963 data, though the magnificent success of AT&T's Telstar has given the business community a strong emotional boost. But, as we can see, the best available realistic alternative for those companies not able to launch their own satellite is to seek out a government contract.

There is a strong desire on the part of our respondents to keep this opportunity available by limiting expansion of government research operations. The limit, we assume most would agree, would be those facilities necessary to equip government to judge satisfactorily the performance of its contractors. And a help in conducting contracting operations and other such activities more effectively would be to give space program administrators greater negotiating flexibility. From our interviews with executives in the space industry we would say that such suggested flexibility would be most useful in making changes while research is going on. That is, to use information gained in research to improve the method of carrying out the project, rather than being forced to do it "just the way the contract says" so that the company won't get stuck in the end.

One way of summing up the role of business in the space program is this statement from an executive in our 1960 survey: "Government should explore the frontiers of space research. Business should develop and apply the government's research findings." We asked executives in this year's survey to comment on this; 62% agree. One could interpret their agreement with this statement as indicating that businessmen now recognize as inevitable that govern-

ment has a strong role in our economy: that the doctrines of John Maynard Keynes have slipped in through the back door. At the same time, it would only be fair to point out that one can find plenty of situations in our economic history in which business has managed to have government "share the risk" (building railroads, canals, national roads) and that the traditional role of government has been to serve as a vehicle for free enterprise goals. Similarly, one could also make the comment that agreeing with the quote justifies a major role for business in government-sponsored projects so as to prevent further incursions into private enterprise. We think some of all three attitudes holds true here.

PAYOFFS QUESTIONED

Earlier in this report I cited a number of very impressive spinoffs from space research, and noted that executives expect our space investment to pay off even more handsomely with radical breakthroughs in our technology. Of late, there have been some sharp attacks from critics who maintain that while there may have been some striking by-products from space and defense efforts, the number has been much smaller than it might have been. At first glance this appears to be complaining because the goose laid only a 14-carat egg. Looking deeper, however, we find a thoughtful controversy.3

With this issue in mind, we put a "cross check" question in our survey to find out what executives think the value of space program research and technology is, by asking whether they agreed with the statement, "The research and technology of our space program are of dubious scientific or economic value." While 14% agree, as many as 83% say they disagree, and 3% "can't say."

Thus, the great majority of our respondents disagree with even this mild doubting of the scientific and economic value of space research and technology. Such a position gibes with our previously reported finding that executives expect both *idea* and *product* payoff.

The scientific or economic value of space program research and technology aside, whatever pavoff does result is a yield from government funds — public money. This fact raises a very thorny question: Who should benefit from the civilian applications of governmentfinanced research? As might be expected, there have been different philosophies and practices in this area among the various government agencies sponsoring research. And obviously this is a very touchy issue among executives in militaryspace industry companies.

What about the possibility of putting patents and other information into a "public domain" pool? ⁴ According to one industry executive whom we interviewed:

"Do they think we are in this for our health? Current contracts aren't profitable, but future applications are. And not only do they take away the specific patents but also background patents — patents and ideas that you spent years and your own money on so that your company would be capable of bidding on advanced research. You can wind up fighting to get back what was really yours to begin with. We would rather deal with those who let us keep our patents for civilian use. The others just won't get the benefit of our inventions."

On the other hand, the National Academy of Sciences-National Research Council comes to a different conclusion:

"Despite the popular impression, industry at large has been relatively slow to introduce new products arising from the atomic-energy, missile, or space technologies. . . . The major inhibiting factor [is] the uncertainty of the profitable return required to attract risk capital and the need for return on investment within a relatively short time span." 5

From our interviews, we would add to the list a lack of marketing orientation which prevents many companies from perceiving consumer needs that could be filled by the potential applications. As Printers' Ink observed last February, "One of the most pressing problems today is the need to translate the developments achieved through government-supported research into goods of direct use to

consumers. Little has been accomplished in this direction." 6

We asked our respondents about these matters, and a full description of their replies can be found in Exhibit XII. Summarizing them briefly:

- 4% propose solutions that entail the government "going into business."
- 51% propose solutions that have the government keep the rights to civilian use, putting the applications into a common pool for all to use either free of charge or for a royalty.
- 28% propose solutions that vest the civilian rights in the company doing the government research either with or without some reimbursement to the government.
- 17% propose that the solution to this problem depends on how much money the government has invested in each individual case or some other solution.

Interestingly enough, compared with all respondents, only a slightly greater proportion of executives in military-space industries suggest solutions which vest civilian rights in the company doing the government research (37% compared with 28%), or propose solutions dependent on the amount of government money invested (25% as against 17%).

As pointed out in the discussion above, however, the problem is more than one of benefit to the company. It is also one of benefit to the consumer by speeding up the process of spinning off government research into consumer and industrial products. Because of this, we asked:

"Space program research may yield products and manufacturing processes that have consumer and industrial uses. What is the fastest

³ See, for example, "Is the Moon Race Hurting Science?" Business Week, May 11, 1963; and "Will Space Research Pay Off on Earth?" The New York Times Magazine, May 26, 1963.

Magazine, May 26, 1963.

See Lee E. Preston, "Patent Rights Under Federal R & D Contracts" (Thinking Ahead), p. 6 in this issue.

The Editors

⁵ A Review of Space Research, publication 1079 (Washington, D. C., National Academy of Sciences — National Research Council, 1962), Ch. 16, p. 6. (Summer Study at State University of Iowa, Iowa City, Iowa, June 17 — August 10, 1962.)

⁶ Walter Joyce, "Why So Few Really New Products?" Part I, February 1, 1963, pp. 25–28.

EXHIBIT XII. WHO SHOULD BENEFIT FROM THE CIVILIAN APPLICATIONS OF GOVERNMENT-FINANCED RESEARCH?

	Possible solution	Per cent of all respondents giving this solution
a.	"The government should hold the patent or rights and establish a government agency to develop and sell civilian products or applications."	1%
b.	"The government should invest the patent or rights for civilian applications in some kind of a joint govern-	
c.	ment-private enterprise corporation." "The government should hold the patent or rights and let all companies use them for civilian applications,	-
d.	the users paying the government a royalty."	
e.	free of charge." "The patent or rights for civilian applications should remain wholly with the company doing the research to exploit as it sees fit, but the company should pay the	
f.	government some kind of a royalty." "The patent or rights for civilian applications should remain wholly with the company doing the research to	16
g.	exploit as it sees fit." "The solution to this problem depends on how much money the government has invested in each individual	12
	case."	12
h.	"Other solutions."	5

way to put such new ideas and inventions into consumer or industrial use?"

The replies:

Method #2: "Have NASA or the military inform all companies about the product or process and encourage them to exploit the civilian or industrial uses."

Method #3: "It is difficult to say which method would be faster," (and other answers). 21%

Obviously, there are some very strong conflicts here; we would not dare predict whether Method #1 or Method #2 would actually work out better. We already have cited complaints that spin-off has not been fast enough by Method #1. We also know that Method #2 poses great communications problems, for some of our respondents have written concerning the difficulty they have had in finding out what technology has been developed so that they can begin to search for applications. We suspect strongly that these two methods may have quite different values attached to them, values which might inhibit the other method from working. Most importantly, our data show that this and the problem of patent vesting are issues for thoughtful and thorough

research before any decision is made by government, for whatever decision is made will probably run into opposition; and that certainly no decision should be made on the basis of social philosophy alone.

MANPOWER

There are those within the scientific community who are deeply concerned about a hidden "cost" of our space programs. This is the "cost" of not accomplishing certain research because talent and interest will be drawn away from many of the sciences and from research jobs in industry into space research. While there may or may not be a basis for this concern, we wondered whether executives were aware of this issue, and the de-

gree to which it mattered to them. With this in mind, we gave two more of our negative-positive statements:

- (1) The space program will have a bad/good effect on scientific research by drawing interest and talent away from research on scientific questions more important to society.
- (2) The space program will/will not draw skilled manpower and scientific talent away from improving consumer and industrial products.

Executives' responses (EXHIBIT XIII) on the scientific research question, showing 9 out of 10 believing the space program has a good effect, are an additional reflection of the sentiment held by executives that space research is being conducted on "valuable" or "important" questions, which we discussed earlier. (See "Payoffs Questioned.") By presenting the statement in the negative, however, we succeeded in causing five times as many people (37% vs. 7%) to indicate that there might be something wrong, a sign that this is a latent issue in the business community.

The split answers on the matter of industrial research indicate that, for our respondents at least, this is a perplexing issue. And to us their response indicates that we have uncovered an area worthy of careful investigation.

As we noted earlier, the space program may be vulnerable if attacked on the grounds that it might not yield the payoff so highly promised since, as our analysis has shown throughout, the

EXHIBIT XIII. THE SPACE PROGRAM'S EFFECT ON OTHER RESEARCH ACTIVITY

PER CENT GIVING THIS OPINION

EFFECT OF SPACE PROGRAM	AGREE		CANT	DISAGREE	
	GENERALLY	PARTIALLY	SAY	PARTIALLY	GENERALLY
BAD EFFECT ON SCIENTIFIC RESEARCH	7%	30%	9%	24%	30%
GOOD EFFECT ON SCIENTIFIC RESEARCH			3%	**************************************	
SIPHONING OF PRODUCT RESEARCH TALENT	13%	33%	5%		
NO SIPHONING OF PRODUCT RESEARCH TALENT	20%	21%	6%		

question of "payoff" — whether in science or products — is important to executives, and is one of their foremost goals for the space program. And the data presented here clearly indicate that such discussion would get a hearing from a substantial minority. Considering the importance of "payoff" to our respondents, this matter is very likely to get a hearing from an even larger group.

The situation we asked about could very well occur. It has been estimated both that the supply of scientists and engineers available for R & D in 1963 should increase by some 27,000 individuals, and that the increase in space-program R & D will require 25,000 new scientists and engineers — almost the entire new supply. The future may very well hold a situation in which industry is short of scientific manpower in order to fill increased military-space research needs.

We discussed the problem of finding people who could fill the gap with George K. Bennett, President of The Psychological Corporation. It is his opinion that:

"In every period of crisis, such as shortage of this kind, we manage to use our ingenuity to discover ways of utilizing people to their fullest capacities. We did this to an enormous extent during World War II. We were able, for example, to train unskilled girls to operate mass spectrophotometers at Oak Ridge, a job that had previously been thought of as strictly for engineers. But we didn't have the engineers.

"I believe that as our space program moves along, we will discover that the repetitive aspects of it can be assigned to moderately intelligent but untrained personnel. Through proper training and careful instruction and supervision, we'll find that they can do the job well. This will relieve the truly creative minds, the top engineers, for the forefront, where the versatility of the individual is at

a considerable premium.

"Similarly, we will have to rethink our ideas about the engineer as an administrator. Where is he needed and where not? There are many bright people with the administrative skills needed to handle the volumes of paper in an engineering organization. They can be trained to understand the work of the engineering group sufficiently so as to function well. By placing such men as 'administrative assistants' we could relieve creative minds to do advanced engineering or scientific work."

Mr. Ramo disagrees with those who state that there is a shortage of engineering talent for either space or industrial research, and states strongly that:

"True, we have no oversupply of the great, creative genius. But groups capable of doing work of the quality that we have come to regard as typical and acceptable are apparently in abundance. If there were a short supply, the government would have to plead with companies to take on portions of the space program. The actual fact is that never has competition been so severe for government work, despite the relatively low profit margin.

"I am personally involved with the management of a \$500-million-a-year industrial operation that happens to be about one-half government or government-related, and one-half nongovernment, purely commercial ventures. I have yet to find a single project of interest to us commercially that we cannot man because of a shortage of engineers and scientists."

No Politics!

One of the themes we discovered in the process of analyzing the comments written on the returned questionnaires was that some executives are very unhappy about political interference in the space programs. Here are some samples from this vocal minority (1 out of 10):

- "I am concerned over the award of space contracts and other government contracts for political reasons, rather than on merit or to the low bidder." [President, large heavy construction company]
- "I deplore the obvious political implications behind the location of major NASA facilities." [Director of Engineering, Iowa]
- "The space program needs more hard-boiled leadership and organization with less influence from politicians seeking a piece of pie for their constituents." [Executive Vice President, Midwest banking house]

We asked executives to comment on a statement somewhat related to these complaints, "The space program should spend money and locate facilities so as to rejuvenate the economically distressed areas of our nation," while some 33% signify agreement, 65% disagree, and 2% can't say.

This response is no doubt tied to our earlier finding that businessmen view efficiency and getting the job done by the best people as extremely important in the space program.

Young vs. Old

Few differences in opinion appear among executives responding to this survey according to their position, industry, business function, or the many other business dimensions used in reporting other HBR studies. Those that we did find meaningful have already been reported. This same finding was true of the 1960 study.

But one interesting, and perhaps important, pattern emerges when we analyze our data on the basis of the respondents' ages. The "young" and the "old" are often on opposite sides of the fence when the space program comes up against economic issues. In addition, there is a marked tendency for older executives to be more conservative in their "support" of the space program all along the line. While the 1960 study also found differences among executive opinions according to the age of the respondents, these were only slight tendencies when compared to the differences we see in 1963, and never in the 1960 study were old and young executives on opposite sides — even on economic issues. In sum, our 1963 data indicate that space has become more of a young man's game.

Some examples:

- 52% of the executives under 40 say "speed up the space program," while 69% of those over 50 say "no!"
- 61% of the executives under 40 favor the space program over a tax cut, while 56% of those over 50 say, "let's have the tax cut" (in the absence of military need for space research).

In fact, it is age that accounts for the 50/50 split among top executives on this hypothetical tax-cut example (see "Dollars & Sense"):

	Per cent of top executives who prefer tax cut to space program (in the absence of military need for space
Age	research)
Under 40	41%
40-44	47%
45-49	50%
50 or over	58%

The issues of government spending and high taxes appear to be more important to older executives than to younger ones. It might be argued that, since older executives are more likely to have higher incomes, they also have more at stake in a tax cut; yet when we hold income level constant, and analyze replies by age, the differences of opinion are still considerably greater than those among income groups.

In general, there is a tendency for men who are older to be more conservative in their view of the space program, space research, and other matters, both when compared to younger men today and to older men in our survey three years ago. Older executives are less caught up in the romance of space exploration, more likely to doubt spin-off, to say it doesn't matter who gets to the moon first.

These relationships of age toward the space program may stem from several sources. Most probably they are associated with the general conservatism which has often been positively correlated with age. (We speak here only of relative conservatism, for it would be incorrect to say that anyone except a very small segment of the executives responding - opts for rejecting the space program given current conditions. This conservatism becomes more important, as we have seen, when the background situation surrounding our space programs changes.)

To a certain extent we are also dealing here with general attitudes toward things new and progressive. In addition, we may have evidence here of a difference of time perspective between old and young executives. That is, the space program is more likely to "pay off" within the lifetime of a younger man. And this explanation helps to account for the preference older executives express for alternatives to space spending that can be seen to "pay off" more quickly and easily. It seems that as the newness of space has worn off, a respondent's general view of life has become more important in his appraisal of the space pro-Younger men, looking more to the future, see more personal and national reward in space research.

Conclusion

Businessmen continue to believe strongly that our space program is both worthwhile and important. But the novelty of space has worn off, and their enthusiasm has a distinctly different cast to it. Executives are considerably better informed about the space program now than they were in 1960, and this knowledge is reflected in a more critical examination of the space program and the issues surrounding it. Whether a function of passing time or their increased knowledge, businessmen appear to have put the space program in perspective. For example, there is general agreement that space spending is just about right, that a speedup is not a matter of high priority.

A concomitant of both greater space spending and increased executive knowledge about the program is the fact that the space program is now being perceived among other government expenditures, rather than as a curiosity. Such a perception in context causes it to be subject to the usual scrutiny given high levels of government spending. Executives are concerned about taxes, about the ability of our nation to carry on its many activities without sapping the taxpayer dry and thereby harming the economy. Whether this concern is realistic or not is irrelevant; it is of concern to them. Thus, if to "speed up" is taken to mean to increase funds, the constraint of already high government spending would make them reluctant to favor increased space spending, given current cold war conditions. The best alternative is to make better use of existing funds, which, as we have seen, is an ideological response to the view that the space program is government, and all government is "inefficient" to some degree. Should competition increase, their decision might be entirely differ-

One additional note on the future. Throughout our analysis we have remarked on those times where an issue was not seen, opinions were widely divided, and the like. We did this in the spirit that

these points should be brought to the attention of the business community for thoughtful analysis and future planning. A few bear repeating here:

- Who should benefit from the civilian applications of government-sponsored research?
- To what extent should government continue to establish its own research laboratories and other such facilities?
- Is the space program a threat to other scientific inquiry?
- Will the space program dry up industrial research and development by drawing away engineering talent?
- What real value is there in the space program spin-offs, and will such spin-offs come about readily?

These problems are of a kind where our respondents' enthusiasm for space research could well cause them to forego an instrumental role in solving them. Many of these issues do not get solved overnight, but are dealt with by precedent, compromise, or perhaps executive order - slowly, until by accretion and precedent a solution is established. In such situations an undesirable practice can evolve so slowly as not to be noticed, yet once accomplished be difficult to revoke. Our readers and respondents may want to put these issues to thoughtful scrutiny, may want to examine them now outside their personal enthusiasm for space research, lest undesirable solutions be thrust upon them.

An executive is simultaneously a "business or professional man" and a "citizen." Consequently, he can react to our space efforts as either man, or as both. However, these two roles are more readily separable in discussion than in reality, for the impact of space activities on economic life is bound to influence an executive's opinions as a citizen. And the executive's role as a patriotic citizen is bound to influence his reaction to the impact of space activities on his economic life. In our 1960 survey, executives responded almost completely as "citizens." In this survey, they are still responding mainly as "citizens," but the "businessman" has come clearly into view.

-Edward E. Furash